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THE THEORY OF CAPITAL.

A FULL description of the present article cannot be conveyed in the few words of a title. The theory of capital here offered is not based on the familiar accounts of economic production found in the text-books, and could not be explained by them. The essay is an analysis of fundamental economic notions and of the process of economic production, leading up to and culminating in a theory of capital.

Its relation to the note on *The Cost of Production of Capital*, published in a former number of this journal,* and to Mr. Bonar's reply,† must be explained. Two years ago, in reviewing Mr. Bonar's *Letters of Ricardo to Malthus*,‡ I said that the gap between the doctrines of Ricardo, Mill, Cairnes, and Sidgwick and those of Jevons, Menger, and Böhm-Bawerk was one not to be filled by describing Ricardo, in the words of Jevons, as "an able but wrong-headed man"; and I added, "For the student who will patiently go over the whole ground of Ricardian economics, comparing it point by point with the economics of the school of Jevons, there is work to do that will not be barren of results." Professor Jevons himself, notwithstanding the slighting way in which he spoke of Ricardo, did not make so complete a break with the older doctrines of English political economy as some of his disciples have imagined. Thus, almost at the beginning of his chapter on Capital, he says: —

> The views which I shall endeavor to establish on this subject are in fundamental agreement with those adopted by Ricardo, but I shall

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* Vol. iii. p. 503, July, 1889.

† Vol. iv. p. 81, October, 1889.

‡ *Political Science Quarterly*, vol. iii. p. 181, March, 1888.

try to put the Theory of Capital in a more simple and consistent manner than has been the case with some later economists.*

He was careful not to deny the influence of cost of production upon value. In the course of his exposition of the theory of labor, he said: —

> It may tend to give the reader confidence in the preceding theories, when he finds that they lead directly to the well-known law, as stated in the ordinary language of economists, that value is proportional to the cost of production.†

A little farther on he repeats in italics, "Value is proportional to cost of production"; ‡ and, on the next page, he sums up the whole doctrine in the following italicized proposition: —

> The quantities of commodity given or received in exchange are directly proportional to the degrees of productiveness of labor applied to their production and inversely proportional to the values and prices of those commodities and to their costs of production per unit, as well as to their final degrees of utility.

It has long seemed to me that one of the most promising undertakings for the modern economist would be an investigation in detail, in respect of some of the more important forms of wealth, of the relations of cost to value as thus conceived by Professor Jevons. In the present article, I hope to make a contribution to such a study. The note on *The Cost of Production of Capital* was a brief preliminary statement of one particular point to be considered. Assuming that goods can be classed as capital only when they constitute a surplus in excess of what must be immediately consumed in subsistence,— an assumption which has been made by the whole line of English economists, even when they have used expressions inconsistent with it, and which is fundamental in the thought of the Austrian writers,—I undertook to show that capital goods necessarily have a higher cost of production per unit of commodity than has produce constituting immediate subsistence, because they must be produced after subsistence has been won,—that is, during the hours in which labor yields diminishing returns. The fact that in the modern world subsistence and capital are undergoing production simultaneously from morning till night in no wise affects the theoretical validity of this statement. Whether produced simultaneously with subsistence or not, if capital, in addition to subsistence, is produced in fact, the working day is longer than it would be if only subsistence were produced, means and methods of production remaining the same; and the resulting higher cost is properly chargeable to the account of capital, not to that of subsistence.

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* *Theory of Political Economy*, edition of 1879, pp. 241, 242; edition of 1888, pp. 221, 222.

† *Ibid.*, edition of 1879, pp. 201, 202; edition of 1888, p. 186.

‡ Page 208 or 191.

This relatively high cost of capital goods, it was argued, affects the value of capital by limiting its supply. There was no suggestion that cost influences value in any other way than by "affecting the quantity produced," nor that, apart from supply, "what gives rise to interest is 'the double, double toil and trouble' of converting things future into things present by overtime and abnormal labor." Mr. Bonar's imputation of such opinions to me, I do not quite understand; for I explicitly pointed out the different questions involved in any investigation of the cause of interest, and as explicitly limited my own inquiry to the problem why capital "is in such limited supply that lenders are able to convert their desire for loan interest into an effective demand." The question whether interest is a problem of surplus product or of surplus value was not discussed. I merely indicated that there is a point of view from which a certain sum of wealth, called economic interest, may be thought of as a unique stream of wealth, drawn by means of capital from the bounty of nature. Mr. Bonar thinks that such a view is inconsistent with the several principles of the school to which Professor Böhm-Bawerk belongs. If so, it is one of the foremost writers of that school who has been guilty of the inconsistency.* My sole purpose in alluding to this view, however, was to mark off the problem that it presents from the one with which I was then dealing. This was necessary, because in recent discussions in this journal, particularly in the articles by Professor Patten † and Mr. Sidney Webb,‡ interest had been viewed as a product of capitalistic production; and it was from Mr. Webb that I borrowed the convenient distinction between economic interest and loan interest. In the present article, I shall take up some of the problems not dealt with in the preliminary note. I purpose to examine the phenomena of capital in their relation to the increase of efficient utility, to cost, and to value.

The fundamental question in regard to capital concerns the work that it performs. To adapt President Walker's remark about money, capital is that capital does; and our first business is to know what capital does, how it does it, and to what extent. The present state of economic knowledge on these points seems to me extremely vague and unsatisfactory. It is not enough to say that capital aids labor in the production of wealth. If any reader thinks that it is, let him compare the definition of the capitalistic function given by Professor Jevons with that given by President Walker. "The single and all-important function of capital," says Jevons, "is to enable the laborer to await the result of any long lasting work,—to put an interval between the beginning and the end of an enterprise." § Turn now to President Walker. Care-fully classifying capital under the three forms, subsistence, tools, and materials, he says: —

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* See Dr. Friedrich von Wieser's *Der Natürliche Werth*, pp. 132–139.

† *The Fundamental Idea of Capital*, vol. iii. p. 188, January, 1889.

‡ *The Rate of Interest and the Laws of Distribution*, vol. ii. p. 188, January, 1888.

§ *Theory of Political Economy*, edition of 1879, p. 243; edition of 1888, pp. 222, 223.

> One of the advantages of this classification is that it directs the attention to the part performed by tools, machinery, and apparatus in the production of wealth. Look into many text-books on Political Economy, and you will find capital spoken of as if its main or even its sole office were to furnish subsistence to the laborer. Yet two nations may be equally provided with subsistence, while the superiority of one of them in the possession of tools may give it a prodigious advantage over the other in the power of producing wealth.*

Can there be any doubt that a theory of capitalistic production must account for this "prodigious advantage"? Plainly, either capital performs another function than that attributed to it by Jevons or materials, tools, machinery, are something more or other than capital. The theory of capital is far from complete, so long as such a question remains unsettled. Evidently, we ought to know just what it is that can be done and is done by such unlike things as a store of food, a stock of materials, a stock of inanimate things called tools and machinery, and a stock of such animate things as flocks and herds and oxen and horses, all of which are commonly regarded as concrete forms of capital.

Professor Böhm-Bawerk, elaborate as is his account of the process of capitalistic production, does not impart this knowledge. He does not, like Sax,† deny that economic theory is concerned with it. On the contrary, though affirming that the economist may, if he chooses, refer the problem to the physicist, he is so conscious that the physicist has not dealt with it, and that no theory of capital can be constructed without it, that he devotes several pages to its consideration.‡ Having shown by examples that capitalistic production differs from production by unaided human labor in being less direct, the production of intermediate products being interpolated between the beginning of labor and the completion of the final goods, and having shown also that such indirect production is more fruitful than direct production, he asks in so many words the question why it is so; * and his answer is that every intermediate product enlists the co-operation of an auxiliary force (*einer Hilfskraft*) that is stronger or better adapted to the work than the human hand.† If this answer is sound, and I hope to show that it is, it enables us to say that Jevons's definition of the function of capital is extremely inadequate, and it justifies the current classification of tools and machinery, with the stock of food and clothing, as concrete capital or capital goods. It does more. It raises a doubt whether a store of subsistence for laborers is itself capital, however long the interval between the beginning and the end of an enterprise, unless, in some way, in the process of consumption, it enlists the *Hilfskraft*. This doubt, faithfully followed, may lead to interesting conclusions; but, before we can follow it, we must be really sure that the work of capital is in fact what we assume, that it is in fact something more than staying power. The longer one reflects on this matter, the stronger will grow his conviction that the problem calls for further analysis. We must know *how* capital enlists the extra-human energies in production. Is the process mysterious? Böhm-Bawerk does not tell us; and, in failing to tell, he fails, like all economic writers before him, to give a really specific and definite answer to the question, What, exactly, is the function of capital in economic production?

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* *Political Economy*, advanced course, new edition, p. 69.

† *Grundlegung der theoretischen Staatswirthschaft*, p. 316.

‡ *Positive Theorie des Kapitales*, pp. xiv–xxiii, and 16, 17, 18.

Not more satisfactory is the state of opinion in regard to the value of the capital function. The ablest economists are not yet agreed among themselves whether capital goods undergoing productive consumption reproduce themselves with or without surplus value. Böhm-Bawerk maintains the negative; while, as was noted a moment ago, Dr. Wieser, in his remarkable book on Natural Value, enters into a long argument to prove that capital does, in fact, yield in production a *reiner Ertrag*,— a true surplus value.

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* "Warum aber ist es so?" at p. 18.

† Page 21.

Such being the present chaos of the "fundamental propositions respecting capital," I have thought it worth while, before inquiring into the cost and value of capital, to attempt to show exactly what capital does in production, and how. The result is a conviction that we must distinguish between capital goods * and capital proper, a distinction not without a difference, and one which, as will appear in the sequel, is not the same as Professor Clark's distinction between concrete capital and pure capital,† though allied to that and leading naturally to it. I expect to show that capital goods in productive consumption reproduce themselves with surplus product, while capital proper, if wisely invested, is not consumed at all, but, augmenting, creates surplus value. Consequently, the essential function of capital in production is scarcely suggested, much less described, in Jevons's definition.

The nomenclature of utility and value will be that of Professor Jevons and the Austrian economists. The technical meaning given by Jevons to the word "utility" cannot entirely supplant the meaning that it has in common speech. I have found it so necessary to employ the word in the common meaning that, when I wish to speak of utility as affected by supply of commodity or by degree of satisfaction already attained, I shall use the phrase degree of utility, final utility, or subjective value. When I use the word "utility" without qualification, it must be understood, according to Roscher's definition, as signifying "a quality of things in themselves, in relation, it is true, to human wants."

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* Or capital plant, capital plant being a better term to use when the capital goods consist of mills and machinery, docks, wharves, warehouses, dikes, canals, roads, railroads.

† *Capital and its Earnings*, in the Publications of the American Economic Association, vol. iii. No. 2.

Political economy needs to adopt from modern biology and psychology notions of wants and satisfactions more definite than the abstract symbols that have been doing too long the duty of true scientific conceptions. Whether or not Mr. Spencer's definition of life as a continuous adjustment of internal relations to external relations is adequate for all scientific purposes, it is at any rate true as far as it goes; and it is certain that a scientific theory of economic production must rest on the postulate that pleasures and pains are the accompaniments of a continuous interchange of matter and energy, *in combinations of increasing complexity*, between the organism and its environment. All satisfactions depend on incomes of matter and energy from without, or outgoes of matter and energy from within, or upon reactions of external things upon the energies of the organism. Insufficient incomes create the pains of depletion and the desire for supply. Excessive incomes create the pains of satiety and over-stimulation and the desire to cut off supply. Insufficient expenditures from within create the pains of *ennui* and the desire for mental or physical activity. Excessive expenditures from within create the pains of weariness or exhaustion and the desire for rest. These are the generic facts of economic phenomena. From them we must derive our conceptions of utility, value, and cost; and, as everything depends on the accuracy and adequacy of our notion of utility, it is of the first importance to see just how those things that we call useful are related to the evolution of life.

If life is a correspondence of internal facts to external facts, it must be conversely true that whatever ministers to life does so by establishing, in some way, a correspondence of external facts to the internal facts established hitherto; and, if the degree of life varies with the degree of correspondence, it must be equally true that the degree of ministration of external things varies with the degree of their adaptation to a process and product of organic evolution, which, in man, if we take account of mental evolution, is becoming complex beyond any power of conception. In a word, not only is utility, regarded as an objective fact, the obverse of that correspondence of internal relations to external relations which constitutes life,— being itself a correspondence of external relations to internal relations,— but *the evolution of utility is always a process of co-ordination*, becoming more and more intricate with the evolution of higher types of life and the corresponding multiplication and refinement of wants.

This is the starting point of a scientific theory of economic production. It is only a small proportion of the wants of a highly developed organism that can be satisfied by the direct action or reaction of natural energies in their simple forms or usual combinations. For the satisfaction of the most urgent wants, and many more of the less urgent wants, external matter and energies must be combined in various highly special ways, as they are in the carbo-hydrates and proteids constituting the various kinds of food, or as they are for the production of instrumental music, or for the pleasurable activity of senses and imagination awakened by articles of adornment and objects of art. On the other hand, certain physical or chemical associations may have to be severed.

These associations and dissociations of external forms and forces that are prerequisites in the satisfaction of wants I shall call preliminary co-ordinations; and the fact to be emphasized is that, as wants become more numerous and complex, the series of preliminary co-ordinations is necessarily lengthened. The total preliminary co-ordination effected for any organism must be sufficient to repay all expenditures involved in the continuous building up and breaking down of tissue; it must make good all the losses of energy that the organism experiences in all its efforts and enjoyments.

How, then, are the preliminary co-ordinations effected? Do they involve any sacrifice on the part of the organism? To answer these questions is to state the first great law of economic production,— the law of profit, namely:

Beyond certain limits, co-ordination involves cost; but, within certain limits, the utility evolved may exceed the cost.

To some extent, the preliminary co-ordinations are effected by external nature, without effort on the part of the organism benefited; but the proportion falls as we pass from the lower to the higher types of life, and from the cruder to the finer wants. Humanity is not provided for, like the amœba, to the extent of having food in solution in immediate contact with its tissues; and the breath of the wind in the murmurous wood of Lowell's lines does not become

> . . . "the music heard once by an ear
> That cannot forget or reclaim it"

apart from the magic of the master's bow. It is the lot of man to invent and to work, to establish new co-ordinations ideally in thought, and then to establish them externally in correspondence to the thought. Energy must be expended and tissue wasted, that tissue and energy may be renewed. It is here that we meet the fact of cost in its generic aspect. Fundamentally, it is a physiological phenomenon; and we find it to be true, as was so ably contended by Professor Cairnes, that cost in the last analysis consists always of sacrifice. For, if, besides the expenditure of human energy that is pleasurable, there must be an expenditure also in creating utility, there is necessarily a sacrifice of pleasurable activity to a corresponding extent.

We must be careful, however, not to confound the physiological expression of cost with the economic expression. Cairnes fell into error when, having resolved all cost into terms of sacrifice, he went on to express sacrifice in terms of fatigue. Fatigue and utility are incommensurate, except through some mean term, as in Jevons's formulas of negative utility. We can never compare utility with cost unless cost itself can be expressed in terms of utility. But this is not merely possible; it is constantly done in all our economic thinking. We do actually measure one sacrifice in terms of another through an intermediate term, which from one point of view is utility, from another point of view is cost, and which is therefore the common denominator required. To give an example: the physiological cost of cutting a cord of wood is the waste of tissue and energy in the work. This loss must be repaired by a consumption of food, and food in relation to the renewal of protoplasm is utility. But the potential energy of the food might be expended in a more enjoyable way than in wood-chopping. It might go into a pleasant excursion or a day's fishing. It might be expended in creating more or less utility than that of the wood,— in finding or making some other kind of goods. From this point of view, the renewal of energy spent in wood-chopping is cost,— a sacrifice measured by the utility or enjoyment that is foregone. So physiological cost acquires an economic measurement in terms of the utility sacrificed to meet it, and the subjective value of this utility is according to the final utility that might be had by consuming the goods or the labor force in question in the best of the other possible ways. Thus, if two hundred pounds of food will keep a man who does no work alive and well for six months, while three hundred pounds must be consumed if he works to the extent of raising two hundred bushels of potatoes, the economic measure of the physiological cost of his labor is one hundred pounds of food. If the labor equivalent of these one hundred pounds of food expended in the next best way would have produced ninety bushels of corn, the sacrifice of one hundred pounds of food in raising the potatoes is equivalent to the sacrifice of ninety bushels of corn at the end of six months;* and this sacrifice measures the economic cost of the potatoes.

The identity of this view with the Austrian theory of cost will be shown later. Cairnes's doctrine, properly stated, and the Austrian doctrine, which at first glance seems to be radically different, are fundamentally one and the same.

If this account of cost is a true one, it enables us to understand how utility may exceed its cost of production. As the expenditure of energy in labor is undertaken because the organism fails to find in the environment enough products of co-ordinated energy to maintain and develop life, it is evident that the income of energy secured by means of labor must be greater than the expenditure in labor, or life will still be curtailed. There must be utility gained in excess of utility sacrificed in the labor process. That within wide limits such gain is possible is because the outgo in labor is an expenditure only in co-ordinating useful energies which in themselves are the bounty of nature. Invention and labor merely prevent the dissipation of these energies in non-useful ways. They create co-ordinative utility, not dynamic utility.

Within what limits net utility can be secured becomes for mankind the economic problem of supreme importance. Because it has been obtained in the past, and is obtained still, we have material comforts, knowledge, art, and the refinements of civilization. Just what the limits are in any concrete case, experiment only can ascertain. But the economist discovers a general law of the utmost consequence, according to which, in all cases, they are determined,— a law of variation, namely:

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* No account is here taken of the value of land in terms of interest or rent.

Beyond certain limits, cost tends to overtake utility, means and methods of co-ordination remaining the same. This is the law of diminishing returns in its most general form. It holds true of all labor whatsoever. As the intensity of labor increases, the rate of exhaustion increases. A man striking a blow with an axe every second exhausts his strength more than twice as fast as in striking once in two seconds. The rate of expenditure increases, also, if continuous labor is prolonged beyond a certain time. For a number of hours, the rate may be nearly constant; but a point will be reached beyond which it will increase rapidly. The rate of cost is thus a mathematical function of the intensity and prolongation of labor. It follows that those goods produced by more intense labor, or by labor that has been long continued, have a higher rate of cost per unit of quantity than those produced by labor less intense or fresher.

The laborer thus secures net utility, but not in unlimited amounts. He may work for a number of hours, getting back more than he gives out. After that, he may still get back more than he gives out, but in a decreasing proportion. He secures only diminishing returns. Finally, exhaustion overcomes him: labor and return both cease. Because of diminishing returns, and for no other reason, labor must be supplemented by other means of co-ordination.

This is the fundamental postulate of the theory of capital. If the net utility of the hours of full return more than makes good all losses of energy during the entire twenty-four hours, the laborer can easily multiply his satisfactions. If it just makes them good, and no more, he can increase his satisfactions only by prolonging his labor into the hours of diminishing return. Which the fact will be depends upon the degree to which the resources of the environment require labor to make them available. If food requiring no preparation is easily obtained at the water's edge or from surrounding vegetation, a very little labor will secure abundant net incomes of energy; but supplies of this kind may begin to fail. The fish within reach from the shore, the fruits and wild grain, become poorer and more scarce. Man is met by the law of diminishing returns of the environment. He finds that, to get enough to eat, he must work until tired. All other satisfactions must be obtained in the hours of increasing fatigue. It is evident that now net utility can be further increased only if the non-useful dissipation of energy can be further prevented without increasing the total expenditure of energy in labor. Bare muscular exertion has accomplished all that it can. Some way must be found to make external nature contribute further to the work of co-ordination. Besides dynamic utility, physical and organic forces must be made to create co-ordinative utility.

The agency that accomplishes this is capital, and the process is capitalistic production. Capital creates no energy, but it prevents the useless dissipation of energy. It co-ordinates matter and energy, and thereby creates utility.

The useless dissipations of energy are in two chief ways. Energies of external nature are perpetually running to waste so far as their relations to human satisfaction are concerned. The bodily energies of the human organism itself are wasted by expenditure at wrong times and in wrong places, by awkwardness or imperfection of muscular efforts, and by lack of continuity. Invention and labor are primarily efforts to diminish wastes of the first class. In these efforts, we become conscious of wastes of the second class; and the elementary capital goods are those that enable us to make the most of our own working powers. The first and most important step in capitalistic production is made when the laborer for the first time becomes fully aware that his strength is subject to ebb and flow, that nature's bounty is distributed periodically in time and irregularly in space, and sets himself to provide a means of adjustment to these conditions. Economists agree in putting a store of food at the head of the capital series. As Mr. Walker very truly says, "An ample year's subsistence forms the most important advance which a people ever make in their progress towards industrial prosperity." * What we must discern in such a store of food, if we would have a rational knowledge of its function as capital, is a means of adjustment to the universal, inexorable laws of rhythm and segregation. It enables the laborer to spare his strength in illness and in storm. It enables the fisherman to put to sea in calm, to stay on shore in tempest. It enables a population to conserve its energies in winter, and at any time to migrate from the less to the more bountiful environment. In brief, its function is to prevent useless dissipations of labor force, by establishing co-ordinations in time and space.

Superficially, the economic function of tools seems to be something different from that of a store of food or a store of materials. Fundamentally, the service rendered by tools and supplies is the same. One and all, they are co-ordinating agencies which economize human energies, and so make possible more numerous and perfect co-ordinations of external energy. It is not an economist, but the biologist Romanes, who has thrown the clearest light on the economic function of tools:—

> From the time that a stone was first used by a monkey to crack a nut, by a bird to break a shell, or even by a spider to balance its web, the necessary connection between the advance of mental discrimination and muscular co-ordination was severed. With the use of tools there was given to Mind the means of progressing independently of further progress in muscular co-ordination. And so marvellously has the highest animal availed itself of such means

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* *Political Economy*, p 67.

that now among the civilized races of mankind more than a million per cent. of his adjustive movements are performed by mechanisms of his own construction.*

The elementary forms of capital goods, diminishing the wastes of human strength in production, enable us to create a second and derivative class of productive agencies of enormously greater efficiency. Provided with a store of food, and with tools and materials, a population can have, and also employ, such productive means as seed grain, flocks and herds, beasts of draft and burden, and machinery. Unlike as these things are in physical qualities, they have one common economic function. The grain of wheat in the earth, starting into a new life that draws together potash and silica, carbon and nitrogen, for whole new ears of wheat; flocks and herds converting grass into meat and milk and wool, and multiplying from generation to generation; the factory that converts coal into power and bales of cotton into lace,— all are in their own several ways co-ordinators of natural energies, and, as such, agencies for preventing the useless dissipation of mighty powers pregnant with human well-being.

Here, then, we have one truth of the utmost significance. Capital goods are not inert. An enormous amount of discussion has been carried on without the faintest perception of the dynamics of the capital function. A plough or a loom has been thought of as so much dead matter. Thus, when Professor Böhm-Bawerk argues that capital is not an independent productive agent,— the only independent productive agents being human labor and natural forces,— he says what is perfectly true in one sense; but he seems to miss the all-important fact that capital goods *are* natural forces in certain highly special combinations. They are matter and energy in a particular form, and working in a particular way. In effecting co-ordination, they are consumed, their matter is disintegrated, their contained energy is liberated. But, if they are capital goods in fact, they do, in consumption, usefully co-ordinate energy in excess of the energy dissipated in their own consumption.

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* J. G. Romanes, *Mental Evolution in Animals*, p. 59.

Therefore, capital goods, capital products, or productive means, by whatever name we prefer to call them, *are matter and energy so co-ordinated that, in the process of disintegration and liberation, they effect other co-ordinations of matter and energy*, to the extent of reproducing themselves with surplus product, thereby creating net utility.

Why not say capital simply? Why distinguish between capital and capital goods? For the same reason that the engineer distinguishes between the steam-engine and its horse-power; for the same reason that the economist distinguishes between coin and money. Two steam-engines exactly alike in pattern and materials will develop different horse-powers. The silver coin of 412½ grains is not the same amount of money now in fact, whatever it may be called in law, that it was ten years ago. In like manner, capital goods exactly alike to outward appearance will have, in consumption, different co-ordinative efficiencies. They will embody capital in different amounts. Nor will the amount of capital they embody be measured by the money spent in producing them. No economist would claim that hoarded money was capital. No more is it capital if spent in building a worthless machine or a useless mill. Capital, then, is co-ordinative power or efficiency in production, and does not necessarily vary in proportion to the amount of capital goods or to their cost. It depends quite as much on the relations of the different kinds of capital goods to one another, and to all the conditions of production. A thousand bushels of wheat in the form of a store of food may have the highest efficiency as capital for a hundred laborers. A second thousand bushels would embody little additional capital, or none at all; but, converted into tools, it would become capital. Again, after each man was provided with a full assortment of tools, including duplicates for loss or accident, an additional lot of tools would embody no capital whatever; but their cost, converted into machinery, would become capital. So, just as money invested in more spinning frames than available motive power will run, or in more factories than the market demands, or in railroads for which there is no business, is no more capital than if it were sunk in the sea, the frames, the factories, the railroads themselves, are not capital, in any true sense of the word.

Does capital, then, augment in production? Does it produce surplus value as capital goods produce surplus product? That all depends on how capital goods, reproducing themselves in consumption, are reinvested. If reinvested wisely in producing new co-ordinations, capital itself is not consumed at all, but continually increases in quantity. Whether the surplus product of capital goods is also surplus value depends, further, on the multiplication of wants. Professor Böhm-Bawerk and Mr. Bonar lay much stress on the proposition that great product is antagonistic to great value. So it is, if wants remain the same. But, in the presence of great product, wants do not remain the same. They develop a power of indefinite multiplication. In a normal condition of things, therefore, capital will yield surplus value,— the true *reiner Ertrag* of Professor Wieser's analysis.

I hope I have now made the nature of capital and its function in production sufficiently clear. To completely differentiate it from other forms of wealth, however, we must know something about its cost and value. These inquiries may be made from two points of view. We may study the cost and value of capital from the subjective standpoint, inquiring what subjective cost and value capital has to the individual producer who has no dealings in the market; or from the objective, or market, standpoint, in connection with the phenomena of interest. We will take the subjective point of view first.

All concrete forms of capital, or capital goods, can be produced by means of the one concrete form, a store of grain. Grain will keep an indefinite time, so answering to the first form of capital as a co-ordinator of human labor with external energies in time and space. It will support the laborer while he makes tools or machinery. It can be used as seed. It can be fed to domestic animals. It is convertible into any or all of the other capital forms. As Jevons said, it is the typical free form of capital; for plainly, when he said food, he had grain chiefly in mind.

Therefore, in considering the worth and cost of capital, we may simplify our problem by comparing the cost and worth of grain used as capital with the cost and worth of grain used as subsistence.

The first thing to be noted is that grain as capital, as distinguished from mere subsistence, must be a surplus. None can be set aside for the purpose of increasing production until the more imperative of present wants are satisfied. It must, therefore, be produced after present subsistence is produced. By this it is not meant that the particular bushels of grain destined to become capital must be produced after the particular bushels destined for immediate consumption, nor that the capital grain must be produced in some subsequent month or year, but that, if men are to have capital for to-morrow in addition to the food of to-day, they must keep on working to-day longer than would be necessary to produce to-day's subsistence only. When, however, men begin systematically to produce capital, it is because they have begun to experience diminishing returns from their work of obtaining supplies for present consumption. No man would lay by a store for bad days if, in his worst days, he could gather manna without appreciable effort; nor would he trouble himself about tools or machinery if he could indefinitely multiply the rapidity of his muscular movements, or if he could indefinitely prolong them without increasing the rate of physiological cost. When capital is systematically produced, it is because without it a population, though putting forth its best efforts, would be ever on the brink of starvation, and because, when capital enables a more abundant subsistence to be obtained, population immediately increases so in numbers that it is still necessary to work a full long day to get enough to eat. Consequently, as capital is produced only by work prolonged beyond the hours necessary for subsistence earning, it is necessarily produced in the hours of diminishing return. We arrive, therefore, at the principle that the cost of production of capital goods is higher per unit of commodity than that of goods constituting present subsistence.

Does it not follow from this conclusion that the product of an hour of overtime labor is worth less to its producer than the product of an hour of less weary labor, and that we have here the contradiction that a kind of goods which reproduce themselves with surplus product, and enormously increase human satisfactions, are worth less to their possessor than goods which have no such self-multiplying power?

Some such thought as this must have been in Mr. Bonar's mind when he pronounced this view of the cost of capital, as it was presented in my preliminary note, inconsistent with the theory which makes the value of an article "more than the total of the wages that have been paid in the making of it." The contradiction, evident as it seems to be, does not exist in fact. The product of overtime labor not only costs more, it may be worth more, than the product of an equal time of fresh labor. For not all portions of food have the same degree of utility. While the first consumed portions have an immeasurable utility, the next a far less, and others yet less, the portions last consumed may have so little utility that the merest trifle would influence the consumer to forego them. Now, in accordance with the law of rhythm above referred to, the abundance gathered in one day will be greater than in another. A certain portion will therefore have a greater degree of utility if added to the supply of the lean day than if added to the day of plenty. If, then, we suppose the product of the eleventh hour of continuous application to be 5 P, and that of the twelfth hour to be only 4 P, it may yet happen that, while one P costs a fifth more produced in the twelfth hour than one P produced in the eleventh, it may have in consumption on a future day a greater degree of utility than the final P consumed to-day. Much more may its degree of utility as capital be greater than its degree of utility as subsistence if by consumption on a future day it prevents a non-useful dissipation of the laborer's energy by permitting him to give up work that would so far exhaust as to cause illness, or, still more, if consumed as seed, or, in enabling the laborer to make tools, its owner secures on a future day with an equal amount of labor a large multiple of P.

But here we meet the question, How compare a future degree of utility with a present? Can we say that a handful of grain is worth more to a man as capital than as a small addition to to-day's food, when the greater utility of its consumption as capital can be realized only in the future, while its utility as food would be realized to-day? Obviously not, unless it appears that we estimate future utility and present utility equally, or that the future utility as estimated to-day is greater, in spite of different standards of estimation, than the present estimate of the utility of to-day.

That we often value future goods less than present goods of the same kind and quantity is certain. Jevons quotes approvingly the dictum of Bentham, that one of the main elements in estimating the force of a pleasure or pain is its propinquity or remoteness.* That is, we under-estimate the pains and pleasures of the future, and "the intensity of present anticipated feeling must, to use a mathematical expression, be some function of the future actual feeling and of the intervening time, and it must increase as we approach the moment of realization." * It follows that the truth about the subjective value of a quantity of grain considered as capital, as compared with its subjective value considered as present food, is this: if the actual utility of the future use as capital were to be no greater than the utility of present use as food, its present subjective value as capital would be less than its present subjective value as food. But, as its actual utility as capital in the future will be greater, in fact, than its present utility as food could be, its present subjective value as capital may be as great or greater than its present subjective value as food. And, unless it is greater, the possessor will not set it aside as capital. Consequently, when men systematically produce capital, not for the loan market, but for their own productive undertakings, the actual utility in the future of a given quantity of wealth used as capital must be so much greater than its actual utility in the present could be, if it were used in present satisfaction, that its present subjective value considered as capital is greater than its present subjective value considered as an addition to the subsistence or luxuries of the hour.

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* *The Theory of Political Economy*, edition of 1879, p. 36; edition of 1888, p. 33.

Capital goods, therefore, are differentiated in point of cost and value from necessary subsistence and from luxuries in two ways. They are distinguished from necessary subsistence in being a surplus — a quantity of goods not indispensable for immediate consumption — and in having a higher cost of production per unit of quantity. They are distinguished from that other form of surplus, which is devoted to increasing the pleasure experienced in consumption,— that is, from luxuries,— in having a higher cost of production per unit of quantity, in having

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* *The Theory of Political Economy*, edition of 1879, p. 37; edition of 1888, p. 34.

a greater utility per unit in the future than luxuries have per unit in the present, and in having, for their possessor, a higher subjective value.

The last-named characteristic of capital goods we shall find to be of prime importance to the theory of their objective, or market, value, which we have now to examine. Measured in terms of interest, the objective value of capital must be explained in a theory of interest. Proximately, interest is neither a phenomenon of distribution nor of production, but of exchange. "Putting money out at interest," wrote Jeremy Bentham, "is exchanging present money for future"; * and interest, in general, is the exchange of a larger quantity of future goods for a given quantity of present goods, or, to follow the phraseology of Professor Böhm-Bawerk, it is the "higher objective value in exchange and higher price for present goods." † The psychological law that men discount the future has been vaguely associated from very early times with the existence of interest; and Bentham, as long ago as 1787, adduced it in reply to the arguments of his day against usury. "*Those who have the resolution to sacrifice the present to the future,*" he wrote (the italics are his own), "*are natural objects of envy to those who have sacrificed the future to the present.* The children who have eaten their cake are the natural enemies of the children who have theirs." ‡ It was left for Professor Böhm-Bawerk, however, to fully develop the implications of this interesting truth. Starting from the premise, "Gegenwärtige Güter sind in der Regel mehr werth als künftige Güter gleicher Art und Zahl," § he says, "This proposition is the core of the theory of interest that I have to present"; and, further, "The natural difference in value between present and future goods . . . is the source from which all interest on capital arises." †

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* *Letters on Usury*, Letter II.

† *Positive Theorie des Kapitales*, p. 299.

‡ *Letters on Usury*, Letter VII.

§ *Positive Theorie des Kapitales*, p. 248.

To see how it arises, we must go back of interest as a phenomenon of exchange to interest as a phenomenon of distribution. It is from this point of view that Böhm-Bawerk regards it. If a large part of the product of industry consists of capital goods, many producers must take a part of their pay for the work they have done, not in wines and cigars, not in travel or elegant leisure or the enjoyment of art, but in the ownership of cattle and tools and barns, machinery and mills, railroads and steamships, great warehouses and vast stores of goods. The enjoyments equivalent in value to all these things must be postponed by somebody. Not everybody will consent to postponement. Future enjoyments are discounted. The great majority of men prefer to make sure of the pleasures of to-day, letting those of to-morrow take care of themselves. If, then, there are not enough pleasures of to-day to liquidate all claims, if a part of the productive community must take a portion of its pay in futures, that part, the capitalist class, will insist on the addition to its share of a sum equal to the difference between the present and the future worth of future goods. In other words, it will demand interest, and, because of the importunity of other people for immediately consumable goods, will be able to get it.

As a proximate explanation of interest, this seems to me to be sound and adequate. In setting it forth with rare clearness and accuracy, and in developing in careful detail its varied implications, Professor Böhm-Bawerk has rendered a great and lasting service to economic science. But I cannot think it a final explanation. It does not go to the bottom of things. The moment we accept it as true, other questions force themselves upon us, and compel us to extend our inquiry beyond the problems of distribution into those of production.

We therefore ask the question how it happens that there exist such things as railroads and steamships, and mills, machinery, and tools, in the ownership of which the men who are willing to postpone their enjoyments, in whole or in part, can take pay for work done in the present and the past. Plainly enough it is on their actual existence that Böhm-Bawerk's theory of interest rests. Drop them out of the totality of economic possessions, capital and interest both disappear. Now, the men who own these means of production do not cease to subsist. They eat and drink: they live in houses and wear clothes. They have not postponed the present consumption of any necessary thing. They own their productive goods *in addition* to goods for immediate consumption. How, then, and why is this addition created? Goods for future consumption can have equivalents in the present, in the shape of productive goods, only by the performance, in the present and the past, of labor in addition to the labor necessary to produce past and present subsistence. That additional labor, more irksome, less productive per hour than fresh labor, will not be undertaken without a motive; and the only known motive lies in the economic fact that productive goods in consumption reproduce themselves with surplus product, thereby hour by hour augmenting capital with surplus value.

Yet this motive, if we admit its existence, is in direct antagonism to the discounting of future goods when they are represented in the present by capital. It compensates, or neutralizes, the discounting. I can see no possible escape from this conclusion. Without interest as a phenomenon of production, we should have no capital at all, and therefore no interest as a phenomenon of distribution. But, with interest as a phenomenon of production, how can it be maintained that the value of means of production, or capital goods, lags steadily behind the value of final products or consumable goods, *unless there is somewhere in the problem another factor yet to be taken account of?* If men get enough out of capital to make it worth their while to produce it in addition to subsistence, why should capital goods exchange at a disadvantage with present consumable goods, unless the utility of capital in production in some way gets cancelled, in whole or in part, by a cost of production?

Nor is this all. The men who own mill shares and railroad stocks are not conspicuous by their abstinence from all present enjoyment. In addition to food and drink, they and their families consume a very fair share of the luxuries of the moment. Instead of postponing their pleasures for the sake of having capital, they have chosen the alternative course of prolonging their labor, or getting other men to prolong labor, into the hours of diminishing return. To the full extent that they have done this, they have converted future goods into present goods. This means that they have measured their discount of future goods in terms of the additional cost of making them present. In other words, this additional cost has become the normal measure of the difference between the future value and the present worth of future goods.

Here, then, seems to be a strange contradiction. Starting from one point of view, we seem to account for interest by a difference of value between present and future goods. Starting from another point of view, we seem to account for it by the extra cost of overtime labor. What is the explanation?

A concrete example will serve best to disclose it. Suppose that two men, A and B, work a rented farm together. They begin with nothing, their tools also being rented. At the end of four years and six months, they decide to dissolve partnership and divide their gains. It is found that they have worked 36,300 hours: A, 19,800; B, 16,500. They have on hand a quantity of potatoes, corn, and pork, and a barrel of cider, a horse and cart, a harness, and tools. They have kept account of the hours of labor spent in obtaining each article of their possessions, and in the division they reckon the value of each item in terms of its labor cost. A's family is small; and he needs, therefore, but a small proportion of the potatoes, corn, and pork for subsistence through the winter. B has a large family, and must take for his share the greater part of these immediately consumable things. It is then found that for the extra produce going to B, and for the extra 3,600 hours that A has worked, reckoning all products in labor time, and all labor hours alike, A must take the horse, cart, harness, and tools. The cider remains to be disposed of. A says: "I must have the cider. You are taking all of your share in things that you can get the use of at once. I can derive no benefit from my share until next summer. The value of means of production lags behind the value of consumable goods. I will take the cider for interest."

What would B reply? Would he not say: "You are taking an unfair advantage of my necessities. It is true that I have the advantage of you now, but you will have the advantage of me next year. Your share is in a form that will enable you, next summer, to create a much larger product than I shall be able to obtain. If the cider were out of consideration, you would not exchange your share, as it stands now, for mine, without something to boot. You would say that you had no use for more than one hog or more than ten bushels of potatoes. If you had more, the meat would spoil, and the potatoes would rot before you could use them. Future goods are worth as much more to you than present goods as present goods are worth more to me than future goods. Take the cider, if you must; but I shall always feel that I have been unfairly treated."

Now, as for the ethics of the argument, every reader of this *Journal* knows that it would have been held unimpeachable by the ablest divines of Christendom for a thousand years. Saint Augustine and Chrysostom would have indorsed it. The Council of Nicæa would have sanctioned it, and Aquinas would have elaborated it to weariness. Nay, the arch-utilitarian, Bentham, would have been self-convicted by it; for he uses it himself, in a passage that I shall quote presently, in his reply to the Aristotelian argument on the barrenness of money. But it is not a question of ethics that we are now discussing. The point here to be noted is that economically the argument of B is sound. Economically, it is a fact that the present discount of future goods is offset by the surplus value created by capital goods; and, as has been shown, if this were not so, capital goods would never be produced at all. No man with a particle of enlightenment in his self-interest would create capital goods instead of present consumable goods, or even take the trouble to borrow capital goods if he could get them without interest, if they were not actually worth as much to him in subjective value as present enjoyments. If, then, the discount of future goods is offset by the reproductive increment of capital, interest, as a phenomenon of distribution, has still to be accounted for.

Suppose, then, that in rejoinder A could say: "The gain that I shall get next year by ownership of these capital goods has been offset already. Our products, all told, are the result of 36,300 hours of labor. You have worked ten hours a day, and I thirteen. That we have over and above our food supplies a large part of our capital goods is the result simply and solely of my having worked an extra three hours a day when tired, while you smoked your pipe or slept. I am not willing to put in those hours at the same valuation as the others. I am willing to let their extra cost to me offset the benefit that I shall get next summer from the ownership of capital; and I then have still the claim of interest against you for taking my share of our possessions in a form not available for present use."

We have here the whole case in brief. There is a distinct element of advantage in the possession of capital goods that is not found in the possession of present consumable goods. If, on the whole, there is such a disadvantage in taking future goods instead of present that interest must be paid, we must find some other element of disadvantage, in the production or ownership of capital, besides the postponement of enjoyment, if we are to account for the remarkable fact that, notwithstanding their productiveness, capital goods exchange at a discount in the market.

Perhaps the reader will feel the force of this consideration more fully if he is reminded that the classical theories of interest have found its efficient cause in the demand for capital on account of its productiveness rather than in the discounting of futurity. Bentham, in spite of his epigram on the children who have eaten their cake, chose this ground when, in the passage to which I referred a moment ago, he undertook to refute Aristotle's remark that all money is in its nature barren. The passage reads: —

> A consideration that did not happen to present itself to that great philosopher, but which, had it happened to present itself, might not have been altogether unworthy of his notice, is that though a daric would not beget another daric any more than it would a ram or an ewe, yet, for a daric which a man borrowed, he might get a ram and a couple of ewes, and that the ewes, were the ram left with them a certain time, would probably not be barren; that then, at the end of the year, he would find himself master of his three sheep, together with two, if not three, lambs; and that, if he sold his sheep again to pay back his daric, and gave one of his lambs for the use of it in the mean time, he would be two lambs, or at least one lamb, richer than if he had made no such bargain.

Manifestly, it would have been difficult for Bentham, after writing this, to argue that the value of a live sheep lags behind the value of a dead one dressed for the turnspit, unless he could show that the sheep-owner is necessarily so poor that he must choose between a live one and a dead one, there being no way in which he can have both, or that, having both, the cost of a live one in addition to a dead one is great enough to cancel, partly or wholly, the prospective value of lambs.

Professor Böhm-Bawerk's pages are full of admissions that to the capitalist class future goods are worth more than present goods; and Mr. Bonar, in his exposition of the Positive Theory of Capital, drops such remarks as these: —

> To a large body of men whom we call capitalists, present goods and future are, on the whole, of about equal (subjective) value: they have more than enough for present wants. If he [the capitalist] has any preference, it is rather for future goods than for present, whereas to the workmen the present goods mean their livelihood.*

The replies to the inferences that should be drawn from such admissions would be, I suppose: first, that even to the capitalist present means of production are worth more than future, because, the sooner productive agencies are set at work, the greater will be the revenue from them; and, secondly, that the children who eat their cake to-day are, after all, the great majority of mankind. Neither of these replies will do. The first shifts the ground, accounting for interest by the productiveness of capital. The second confounds the number of buyers in a market with the aggregate of their demand. The capitalist's demand for future goods is far larger than the improvident man's demand for present goods. The manufacturer may demand $100,000 worth of capital products, while his employee demands ten dollars' worth of produce for subsistence. Taking the production and consumption, present and future, of society as a whole, the demand for present consumables and for capital goods must, by Professor Böhm-Bawerk's own showing, nearly or quite balance, since it is one of his cardinal doctrines that the value of means of production is fixed by the value of final products. Increase the demand for wheat, and you increase the demand for ploughs and reapers, for steel rails, freight cars, and elevators. Now, the value of these means of production may, as Böhm-Bawerk affirms, lag behind the value of wheat, the final product, by so much as men discount the future, provided one other condition is not present to complicate matters. That other condition which must be reckoned with is the possibility, nay, the certainty, that, if means of production can be set going to-day that will result at the end of a year in a greatly increased yield of wheat, the new supplies, raising the marriage-rate and lowering the death-rate, raising the standard of living for whole classes and stimulating a thousand demands in the arts, will react powerfully on the value of all capital goods. In a highly organized and growing society, where men make plans far into the future, the value of capital goods is determined not solely by the present demand for consumables, but quite as much by estimates of future demand. There is therefore no reason whatever for concluding that, in such a growing society, capital goods must exchange with consumable goods at a discount, unless it appears that anticipated gains from capital are partly or wholly cancelled by the immediate cost of producing capital goods.

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* *Quarterly Journal of Economics*, April, 1889, vol. iii. pp. 340, 344.

To sum up our conclusions at this point: We can account for interest as a phenomenon of distribution by the difference in value between present and future goods, provided the gains of capital, which would make future goods the more valuable, are offset by a cost of production, and not otherwise. We can account for interest by the limitation of the supply of capital goods through their cost of production, provided we can offset the gains of capital by the discounting of futurity, and not otherwise.

In either case, the normal measure of the discount of futurity is the extra cost of converting things future into things present.

Is not such a doctrine at direct variance with the theory which makes cost the effect rather than the cause of value? This question must be answered by explaining that the Austrian doctrine of cost, so expressed, is equivocal and misleading. What the Austrian writers really mean, and what they ought always to say, is that the value of any means of production is governed by the value of that resulting product which has the lowest final utility or subjective value; that this value is cost in reference to all other products made from or by the same productive means; and that this cost, determining the supply of the other products, determines their final utility, and thereby their value. "In fact, to our surprise we find that in the case of replaceable alternatives it is (in all instances but one) the cost that determines the degree of value after all; and the common identification of cost and price is therefore (in their case only) perfectly justified." *

But "their case only" is practically the case of the great mass of freely produced commodities. The truth is that the Austrian writers have not been able, more than was Jevons, to get away from the fact that cost is the intermediate term between value and value, as the acorn is the intermediate term between oak and oak. Their doctrine of cost, as I said before, in the last analysis is identical with that of Cairnes. Cost is utility sacrificed for the sake of a greater utility. The utility sacrificed is the utility obtainable by spending our labor or consuming our goods in the best of other ways, and our estimate of that way is revealed by the lowest use to which we put either labor or goods. If a laboring population will maintain its numbers and perform its tasks for a bare subsistence, that

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* James Bonar, *The Austrian Economists and their View of Value*, *Quarterly Journal of Economics*, October, 1888.

is its estimate of the utility of its labor,—the subjective value of it,—and is the measure of cost of production in the industry of that community. If it demands, also, some of the comforts of life, the measure of cost is changed. Thus, starting from either the Ricardian or the Austrian standpoint, we arrive at the same conclusion. The lowest use to which we devote labor or goods is our measure of cost; and cost, governing supply, governs the value of other commodities freely produced.

We need have no hesitation, therefore, in explaining the value of capital by its cost of production, while still identifying value with final degree of utility. The market value of capital is governed by the marginal productiveness of capital goods. That marginal productiveness, in any given state of invention and the arts, is governed by the supply of capital goods. The supply of capital goods is governed by their cost of production, and their cost of production is determined by the diminishing returns of intensified or protracted labor. In a new or undeveloped community, the rate of interest is high, because the marginal productiveness of capital goods is not kept down by supply, supply being limited because, without the machinery, skilled labor, and means of transportation of older countries, the cost of production is high. In a highly developed community, the rate is low, because marginal productiveness is kept down by supply, since, with the large accumulations of capital already existing, additional capital goods can be produced without so great intensification or prolongation of labor.

One more question remains to be answered; and, after what has been said, the answer may be very brief. If the supply of capital is governed by the cost of its production, and if the cost of production is resolved into the excessive cost of overtime labor; but, if capital, once produced, yields surplus product: why may not interest fall to zero through the possibility of producing, by means of capital, all necessary subsistence, all desirable luxuries, and abundant renewals of capital goods in a short working day, without over-exertion? The reply is that interest is maintained by the same conditions that lead to the invention and use of capital in the first instance; namely, diminishing returns, multiplying wants, and the pressure of population on the means of subsistence. So long as these conditions of industrial life continue, the majority of mankind will be held inexorably to a working day of a length and intensity that reach or pass the point of diminishing productiveness. Two of the conditions are permanent. The law of diminishing returns is no more subject to human will than the law of gravitation. The multiplication of wants is inseparable from the mental progress to which all new co-ordinations of natural energies and all the resulting increase of wealth are due. The rate of increase of population is the one factor that diminishes as mental power increases. The one way of relief is to multiply mental power at the expense of the population rate. That alone will enable a community to create its capital without over-exertion or protracted working hours. The conclusion of the whole matter, though reached in another way, is identical with that of the orthodox English economy. The decline in the rate of interest in a growing, prosperous community measures the growth of the power of productive co-ordination in proportion to the growth of population.

In conclusion, it may be well to indicate three or four points in which the theory of capital here set forth agrees with or differs from certain other theories besides that of Professor Böhm-Bawerk. It agrees with that of Adam Smith in holding that all capital is stock, but that not all stock is capital, therein differing from the theory of Jevons. It differs, further, from Jevons's theory in that it does not find in capital something that allows us to expend labor in advance, but something that rewards us for so doing. It *obliges* us to expend labor in advance, but enables us to work in another and more advantageous way; and, what is of vastly more importance, it enables us to make natural forces work for us in another and immeasurably more advantageous way.

The present theory is accordingly in essential agreement with the view of Professor Patten, as stated in this Journal a year ago. Most certainly the fundamental fact in the function of capital is that of working in another way. But it is more than the fact of human labor working in another way: it is nature working in another way. This is not, however, the fundamental fact in the production of capital. The underlying facts there are invention, or the establishing of new co-ordinations ideally, and overtime labor, by which these ideal co-ordinations are converted into objective fact.

Finally, the present theory is in fundamental agreement with the deepest truth attained by one of the clearest and profoundest economic thinkers of any time or nation,—I mean the law of normal value as stated by Professor Cairnes.

FRANKLIN H. GIDDINGS.

BRYN MAWR COLLEGE.